Report for 2001NJ1161B: Human Components of Exotic Species Invasion in Urban Forested Wetlands

There are no reported publications resulting from this project.

Report Follows:

Problem and Research Objectives:

There have been many studies looking at the general effects of urbanization and edge effects (Saunders *et al*. 1991, Sukopp *et al*. 1998, Pouyat *et al*. 1995, Zhu & Ehrenfeld 1999), but very few have considered how different types of land use and specific human activities could affect the floral and faunal community composition in urban ecosystems. While it has become dogma that urbanization promotes exotic invasion, my preliminary studies reveal that there is a significant difference in the number of exotics and the extent of invasion among wetland patches in the urban environment. These differences appear to be associated with the type of land use around the wetland and the activities that take place within the wetland. Specifically, wetlands in industrial areas are less invaded (defined by exotic species abundance and richness) than wetlands in residential neighborhoods. There is also a higher presence of exotics in the interior of sites that have either ditches or trails (Bowman Cutway, unpublished data).

I have focused on the effects that humans have on exotic species invasion in urban-forested wetlands at two levels of human interaction. My research set out to test two hypotheses. First, the different types of land use on the edge of an urban wetland will have different effects on the abundance and richness of exotic plant species. It is my hypothesis that edges along residential land use have a higher richness and abundance of exotics. Second, the presence of direct human activity within the site is correlated with a higher richness and abundance of exotic species in the interior of the wetland.

Methodology:

I am testing my hypotheses by examining the invasibility of forested wetlands (Cowardian Class PF01) in the Arthur Kill drainage basin in the central and northeastern New Jersey piedmont. Within the Arthur Kill watershed, I have a total of 17 study sites broken into several categories based on size and landscape position. Sites were selected by using NJDEP wetland inventory maps and aerial photographs, followed by a field visit for ground verification of site condition. I separated study sites into large (>50ha.) and small (<20 ha.) wetlands. Within the small category, wetlands have been separated by land use categories (residential vs. industrial) and shape/position categories (narrow riverine corridor vs. round, disconnected from a major waterway). All possible large study sites are within residential areas. Land use categories are determined by using aerial photographs and zoning designation. Very large box-like buildings, extensive parking lots, railroad tracks and roads characterize industrial sites. Vegetation is found in waste areas and small lawns surrounding the buildings, which are mown but not landscaped. The residential matrix usually consists of single-family homes on a range of lot sizes with mown and landscaped yards adjacent to the wetland. Small neighborhood parks with playground equipment are also commonly adjacent to the wetlands. Through this approach of considering two urbanized land use types, comparisons between categories can be made in addition to characterizing overall patterns.

Vegetation sampling was conducted in 2 x 2 meter plots set on transects with groups of 9 plots on 3 lines. Transects were located on two different edges, and within the interior along disturbances (trails and ditches), and in areas undisturbed by trails and ditches. Sample plots were perpendicular to the point of interest in intervals of 25 meters

(figure 2). The number of plots per site depended on site size and varied from 18 to 36. Within each plot, cover of herbaceous plants, number of shrub stems and tree seedlings were recorded. Diameter at breast height (DBH) of the tree closest to the plot was measured and an estimate of basal area of each tree species was made using a cruise angle. Canopy density was measured using a GRS densitometer. Bareground and trash cover estimates were made as indicators of disturbance (Crawley 1987).

Additionally, I conducted a perimeter study to determine which wetlands are in close proximity of an exotic seed source and if some species are more common on one type of edge. For the perimeter study, I walked the entire perimeter of each wetland and noted the number of exotic species within 5 meters of the wetland edge, the presence of ditch and trail entrances, density of trash, and physical disturbance of the land (deranged topography). I also made a detailed record of the land use adjacent to the wetland.

Principal Findings and Significance:

According to my vegetation sampling in 2000 and 2001, the number of exotics on the perimeter of each site only varied from 11 to 23 and there is no significant difference between land use, size or shape types. This indicates that there is a seed source available to each of these wetlands. However, the frequency of invaded plots differed in terms of size and land use categories. Riverine sites are the most invaded with a high percent of quadrats with at least one exotic species present (78-100%). Large residential sites had a surprisingly high number of invaded plots (31-52%), but the largest and least disturbed by trails had the lowest of that group (31%). Of the small class size, all industrial sites had a relatively low percentage of invaded plots (9-19%). Small residential sites were higher (39-78%) than small industrial and lower than small residential corridor sites, but there is no significant difference in percent of invaded plots between small and large residential (figure 5). In terms of herbaceous cover, there is a significant difference between small industrial, small residential and small residential corridor. There is not a significant difference between small industrial and large residential or small residential and large residential (figure 6).

Of the transect types, exotics were much more likely to be found on the edge and along trails and ditches (table 2). 50% of edge plots (n=301), 22% of the ditch plots (n=50), and 30% of trail plots were invaded while only 16% of interior plots (n=121) were invaded. The most common exotics in urban-forested wetlands were *Alliaria petiolata, Lonicera japonica, Microstegium vimineum, Polygonum cuspidatum,* and *Rosa mutiflora.* These common exotics are characterized by a variety of dispersal mechanisms (table 2). Interestingly, the species that were found in sampling plots are not always just a subset of those on the perimeter.

During the summer of 2002, my research will further investigate the role of land use and human disturbance on invasibility by first, collecting seeds from seed traps to determine if seeds are entering the site at different sampling areas, how many seeds, which species, and propagule type (native and exotic). Second, a seed bank study will track both past and present dispersal events. Third, I will survey soil and hydrological conditions to determine id particular conditions encourage the establishment of exotic species.